905 PC CONCRETE EQUIPMENT

905.01 BATCH PLANTS FOR PORTLAND CEMENT CONCRETE

(A) GENERAL. The batching plant for portland cement concrete shall include bins for either stationary or portable type, with adequate separate compartments for cement, cement substitutes, fine aggregates, and for each size of coarse aggregate, each compartment designed to discharge efficiently and freely into the weighing hopper or hoppers. The plant shall be equipped with a laboratory in accordance with 106.06.

The weighing hoppers shall be properly sealed and vented to preclude dusting during operation. Particles shall be controlled within EPA requirements. The batch plant shall be equipped with a suitable nonresettable batch counter which will correctly indicate the number of batches proportioned.

All batching plant structures shall be properly leveled within the accuracy required by the weighing mechanism design.

(B) BINS AND HOPPERS. Bins with adequate separate compartments for fine aggregate and for each size of coarse aggregate shall be provided in the batch plant.

Hoppers shall be constructed so as to eliminate accumulation of tare materials and to fully discharge without jarring the scales.

All hoppers except cement shall have a means of removing an overload of any one of the several materials.

Partitions of sufficient size to prevent spilling under working conditions shall separate the cement and aggregates in the weighing bins and in the hoppers.

(C) SCALES. The scales for weighing aggregates and cement shall conform to the requirements of 109.01 and the following requirements. When beam-type scales are used, provision such as a "tell-tale" dial shall be made for indicating to the operator that the required load in the weighing hopper is being approached. A device on weighing beams shall indicate critical position clearly. The weigh beam and "tell-tale" device shall be in full view of the operator while charging the hopper, and he shall have convenient access to all controls.

Graduated dials shall be provided with suitable markers, inside the glass cover and in front of the dial, which may be set to indicate the position of the dial indicator for predetermined loads in the weighing hopper.

The hopper and scales shall be suitably enclosed to protect against the influence of wind.

Ten 50 pound standard test weights shall be provided at each batch plant for testing weighing equipment.

The scales shall be maintained within a tolerance of 1/2 percent of the net load in the hopper. The minimum graduation on the beam or dial shall not be greater than 0.2 per cent of the rated capacity of the scales. All cement handling, weighing, and batching apparatus shall be protected from the weather.

Clearance between scale parts, hoppers and bin structure shall be such as to avoid displacement of or friction between parts due to accumulations, vibration, or other causes. Pivot mountings shall be designed so none of the parts will loosen and so as to assure constant spacing of knife edges under all circumstances. Scales shall be so designed that all exposed fulcrums, clevises, and similar working parts may be readily cleaned. The weighing mechanism of the scales shall be constructed of noncorrosive materials, of hardness greater than brass. Weigh beams shall have leveling lugs, and weighing parts of other types shall be provided with means for precision adjustment. Scales shall be inspected, calibrated and properly sealed at the expense of the Contractor when required by the Engineer.

(D) AUTOMATIC WEIGHING DEVICES. Batching plants shall be equipped to proportion aggregates and bulk cement by means of automatic weighing devices of an approved type.

(E) WATER MEASURING EQUIPMENT. The accuracy of the water measuring equipment shall be within 1/2 percent error. The measurement shall not be affected by variations of pressure in the water supply line and will be accurate under all construction conditions encountered. Unless the water is to be weighed, the water measuring equipment shall include an auxiliary tank from which the measuring tank shall be filled. The measuring tank shall be equipped with an outside tap and valve to check the setting unless other means are provided for readily and accurately determining the amount of water in the tank. The volume of the auxiliary tank shall be equal to or greater than that of the measuring tank.

905.02 MIXERS, PAVERS AND DELIVERY EQUIPMENT

(A) TRUCK MIXERS AND AGITATORS. Truck mixers and agitator trucks shall meet the requirements of AASHTO M 157 for Ready-Mixed Concrete and be equipped with a back-up alarm meeting the D.C. Safety Code. Each truck shall be numbered in a permanent, readily visible manner. Each mixer and agitator shall have attached to it a metal plate or plates on which is marked the capacity of the drum or container in terms of the volume of mixed concrete for the various uses for which the equipment is designed and the speed of rotation of the mixing drum or blades.

(B) CENTRAL PLANT. The mixer shall be of an approved design of the batch type and have a rated capacity of not less than 27 cubic feet of mixed concrete. The mixer shall be capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period, and of discharging the mixture without segregation. The mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum has been charged and release it at the end of the mixing period. The device shall be equipped with a bell or other suitable warning device adjusted to give a clearly audible signal each time the lock is released. In case of failure of the timing device, the mixer may be used for the balance of the day while it is being repaired, providing that each batch is mixed in 90 seconds. The mixer shall be equipped with a suitable batch counter which shall correctly indicate the number of batches mixed.

The mixers shall be cleaned at suitable intervals. The pickup and throw-over blades in the drum or drums shall be repaired or replaced when they are worn down 1/4 inch or more. The Contractor shall (1) have available at the job site a copy of the manufacturer's design showing dimensions and arrangements of blades in reference to original height and depth, or (2) provide permanent marks on blade to show points of 1/4 inch wear from new conditions. Drilled holes of 1/4 inch diameter near each end and at midpoint of each blade are recommended.

(C) NONAGITATOR TRUCKS. Bodies of nonagitating hauling equipment for concrete shall be

smooth, mortartight, metal containers and shall be capable of discharging the concrete at a satisfactorily controlled rate without segregation. Concrete shall be discharged from the bottom of the container. Covers shall be provided when needed for protection.

(D) PAVING MIXER. The concrete paving mixer shall be of an approved design of not less than 27 cubic feet and equipped with boom and bucket delivery. The bucket shall be so constructed that it will distribute the concrete on the soils base in a uniform and satisfactory manner. The mixer shall be equipped with a batch meter and an approved timing device which will automatically lock the discharge lever during the full time of mixing and release it at the end of the mixing period. This device shall be equipped with a bell adjusted to ring each time the lock is released.

Pick-up and throw-over blades in the drum of the mixer shall be replaced when they have lost 10 percent of their depth and shall be repaired or replaced when broken or cracked to such an extent as to interfere with the mixing of the concrete. The drum shall be kept clean and free from accumulation of concrete at all times.

The skip of the mixer shall be of such capacity to contain the materials dumped into it without spillage. The drum of the mixer shall be loaded in such a manner as to avoid the loss of any part of the batch due to spilling.

The auxiliary heater of the side arm type with BTU capacity for maintaining continuous water temperature of 70° F or more as required to maintain proper concrete temperatures shall be included as a part of the stationary mixer.

The manufacturer's maximum normal rated capacity shall be clearly indicated on a plate fixed to the mixer machine. No drum shall be loaded in excess of the maximum rated capacity as indicated on this plate. The mixer shall also be equipped with an accurate automatic water measuring device. The water measuring equipment shall include an auxiliary tank of approved design from which the water measuring tank shall be filled. The volume of the auxiliary tank shall be not less than the volume of the measuring tank.

The equipment shall be so arranged that the water pressure in the measuring tank cannot exceed that in the auxiliary tank, due to the difference in elevation between the two tanks. The water shall be automatically stopped when the desired quantity has been delivered. The type of equipment shall be such that the quantity of water delivered shall not be effected by tilting the mixer in any direction. There shall be no leakage throughout the water system. The water measuring equipment shall be capable of measurements to 1/4 gallon and shall be so arranged that the accuracy of measurement will not be affected by variations in pressure in the water supply line.

905.03 FORMS FOR CONCRETE PAVING

(A) PAVEMENT, BASE AND ALLEY FORMS. Straight side forms shall be made of a metal having a thickness of not less than 7/32 inches and shall be furnished in sections not less than 10 feet in length. Forms shall have a depth equal to the prescribed edge thickness of the concrete, without horizontal joint, and a base width equal to the depth of the forms. Forms shall be provided with adequate devices for the secure setting so that when in place they will withstand the operation of the paving equipment. Flange braces shall extend outward on the base not less than 2/3 the height of the form. Forms with battered top surface, and bent, twisted, or broken forms shall be removed from the work. Repaired forms shall not be used until inspected and approved. Built up forms shall not be used except where the total area of

pavement of any specified thickness on the project is less than 2,000 square yards. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet, and the upstanding leg shall not vary more than 1/4 inch. The forms shall contain provision for locking the ends of abutting form sections together tightly and for secure setting.

(B) CURB, GUTTER, CURB AND GUTTER, AND SHOULDER FORMS. Forms for this work shall meet the requirements of (A) above with the following exceptions, changes, or additions.

Forms for portland cement concrete curb shall be of a depth equal to the depth of the curb. The face form shall have a batter of 1/2 inch from the top of the curb to the flow line of the gutter.

Back forms for combination curb and gutter shall be of a depth equal to the combined depth of the curb and gutter. The forms for the face of the curb and the face of the gutter shall be a depth equal to the depth of the curb and gutter respectively. The face form of the curb portion shall have a batter of 1/2 inch from the top of the curb to the flow line of the gutter and shall be so designed that it may be securely attached to the back form. When so attached, it shall be of such rigidity as to maintain a true line when concrete is placed against it.

Forms for curb, the face forms for combination curb and gutter, and the back forms for combination curb and gutter will not be required to have a base width equal to or greater than the depth of the form nor will flange braces be required. However, other means for bracing will be required.

Forms of curb, gutter, curb and gutter or shoulder, that have attachments or plates of any type that create planes of weakness at other than the specified intervals will not be permitted.

(C) SIDEWALK FORMS. Sidewalk forms shall conform to the requirements of (A) above except that the steel shall be not less than 10 gauge in thickness; the requirements pertaining to base width/face depth relation and the requirements for flange braces need not apply. Only 2 stake pockets will be required for each 10 feet of form. However, fabrication of the forms shall be such that they will withstand handling and remain true to line and grade under construction conditions.

905.04 GRADE TEMPLATES

Templates for checking final grades of the soils base shall be rigidly constructed and shall be of such length as to span, from form to form, the section to be tested. The template shall be adjustable to the crown desired and shall be provided with shoes to ride the top of the forms without variation from the desired elevation. Adjustable tines of equal length and spaced at 6 inch intervals shall be attached to the bottom and aligned throughout the entire length of the template.

905.05 SPREADING MACHINES

The concrete spreading machine shall be power driven and capable of spreading the concrete to the full width and depth specified. It shall have multiple speeds in both reverse and forward gears.

The apparatus shall be capable of spreading the concrete to both the depth specified for reinforcement and the full thickness of the slab without segregation and without interfering with the joints or reinforcement. It shall not disturb the form due to lateral pressure of the spreading operation and the weight of the machine shall not cause settlement of the forms.

The spreader shall be equipped with traction wheels with dismountable rims to be used when operating on concrete. Suitable means shall be provided to keep material off the wheels and the top of the forms or slab.

The spreading shall be accomplished by a suitable device of the reversing type, followed by a strike-off screed. The strike-off screed shall be adjustable to the specified crown and section.

905.06 CONCRETE FINISHING MACHINES

(A) ROADWAY. The concrete-finishing machine shall be power driven and of the transverse-screed type. It shall be equipped with traction wheel or wheels with dismountable rims to be used when operating on concrete. Suitable means shall be provided to keep material off the wheels and the top of the forms or slab.

The finishing machine shall be equipped with 2 oscillating type transverse screeds which shall be maintained in the best possible condition and adjustment throughout their use. The front screed shall be used for striking off excess concrete to exact grade and crown.

The rear screed shall be used for finishing and smoothing. All screeds shall be constructed of steel, capable of being adjusted to the specified cross section and of such rigidity as to produce the specified crown and cross section.

Each screed shall be of the floating or suspended type and at least one and one-half feet longer than the width between the forms. They shall be easily and quickly adjustable to the width required.

Both the machine and the screeds shall have variable speeds and be independently controlled. The weight of the machine shall not cause settlement of the forms upon which it operates.

(B) BRIDGE DECK FINISHING MACHINES. The specific method and equipment that the Contractor proposes to use will be subject to the approval of the Engineer. Approval of method and equipment will not relieve the Contractor of full responsibility for obtaining the required finished surface.

The concrete finishing machine shall be hydraulically driven, capable of variable traveling speeds in both forward and reverse directions. The machine shall have a rotating auger and cylinder device which shall oscillate in the transverse direction for leveling and finishing concrete. The auger shall be 8 to 12 inches in diameter and shall be capable of leveling the concrete to the approximate finished grade. The cylinder shall have the same diameter as the auger and shall be approximately 4 feet long. The cylinder shall be capable of consolidating the surface and screeding to the final finished grade while traveling in one transverse direction and finishing while traveling in the opposite direction. A pan- type vibrator shall be mounted directly ahead of the auger to insure final compaction of any surface voids caused by workers after initial vibration. A steel float pan shall be mounted directly behind the cylinder and shall be capable of imparting a final seal to the concrete.

The machine carriage shall be fully adjustable. The machine shall be capable of being adjusted in the vertical direction to within 1/16 inch of the elevation and cross section shown on the plans, including parabolic and straight crowns. The machine shall be capable of being adjusted to any width from 12 feet to the full width of the bridge deck. The machine shall be capable of automatically widening or narrowing to finish tapered deck areas. The machine shall be kept in true adjustment. Machines out of adjustment shall

not be used until proper adjustments have been made and the adjustments approved by the Engineer.

(C) COMBINATION MACHINES. Machines which have both spreading and finishing capabilities shall conform to both requirements of 905.05 and 905.06(A). When two screeds are not provided by a combination machine, the Engineer will require that a minimum of two passes with the same machine be made to provide adequate floating and consolidation.

(D) SLIP FORM PAVER. The slip form paving machine shall be approved by the Engineer prior to starting the paving operations. It shall be self-propelled and be designed for the specific purpose of placing, consolidating, and finishing concrete pavement slabs true to grade and cross section in one complete pass with the use of fixed side forms. The machine shall be equipped with means for spreading the concrete to a uniform depth before it enters the throat of the machine. The machine shall vibrate the concrete either externally or internally with sufficient intensity to consolidate the concrete throughout its entire depth and width.

905.07 VIBRATORS

(A) MOUNTED. Vibrators for full width vibration of concrete paving slabs shall be the internal type with either immersed tube of multiple spuds. They may be attached to the spreader or the finishing machine, or may be mounted on a separate carriage. They shall not come in contact with the joint, load transfer devices, subgrade, or side forms. The frequency of the surface vibrators shall not be less than 3,500 impulses per minute and the frequency of the internal type shall not be less than 7,000 impulses per minute for spud vibrators.

When spud type internal vibrators, attached to spreaders or finishing machines, are used adjacent to forms, they shall have a frequency of not less than 3,500 impulses per minute.

(B) HAND HELD. Internal vibrators, such as the spud type, for compacting concrete at joints and manholes shall be of an approved type and shall operate at a frequency capable of producing at least 5,000 pulsations per minute. They shall not be of such weight as to be unwieldy in application and shall have sufficient cable to permit movement to any location by the Engineer.

905.08 MEMBRANE CURING EQUIPMENT

(A) PAVEMENT WIDTHS OF 9 FEET OR MORE. For pavement widths 9 feet or more, membrane curing, if used, shall be applied by equipment meeting the following requirements:

The equipment shall be self-propelled and shall be operated upon the pavement forms. The spraying equipment shall consist of a container having a capacity of not less than 25 gallons in which a constant pressure can be maintained by mechanical means, or a suitable pumping arrangement in order that a constant pressure at the spray nozzles will be maintained, so that the membrane curing compound will be applied uniformly at the specified rate. The spray unit shall be rigidly attached and shall be equipped with mechanical devices providing constant agitation of the membrane curing compound and continuous circulation of the compound between the container and the spray pipe so the spray will be applied vertically from not more than 2 feet above the surface of the pavement, and their horizontal spacing shall be such that uniform coverage of the pavement surface will be obtained. The nozzles shall be designed so they will deliver a uniform fine spray and so that they can be easily cleaned. A suitable shield or apron shall be provided to effectively protect the spray from the wind. Sufficient nozzles shall be on hand at all times so that any inefficient nozzle can be immediately replaced. Suitable means of cleaning and repairing the nozzles shall also be on hand and shall be considered as being part of the spraying equipment.

(B) PAVEMENT LESS THAN 9 FEET WIDE. For pavement widths less than 9 feet, for sidewalks, curb and gutter, or irregular shapes, the equipment used to apply membrane curing compound may be equipped with a container having not less than 5 gallons in which a constant pressure shall be maintained by a mechanical means. The equipment does not have to be self-propelled.

905.09 HAND TOOLS

(A) HAND STRIKE-OFF SCREEDS. Hand screeds for striking off concrete prior to final finishing shall be made of metal or metal shod wood construction with convenient handles for even operation. The length shall measure 4 feet greater than the slab upon which it is used. The screed shall weigh not less than 15 pounds per linear foot and shall be of such rigid construction that it will not reduce the crown of the slab nor disturb the center longitudinal joint because of any sag in the midsection.

(B) EDGING TOOLS. Edging tools for use on finished concrete shall be made of metal and be 2-1/2 inches in width. They shall have radii of 1/4, 1/2, 3/4 or 1 inch as required.

(C) FLOATS. The small hand float used to finish the pavement surfaces adjacent to the curb shall be made of wood and be at least 12 inches in length.

The float used to finish concrete pavement shall be 8 inches in width and a minimum of 4 feet in length. The minimum length of attached handle shall be 16 feet and at least 4 feet longer than the width of the slab on which it is used.

(D) BROOMS.

(1) FOR USE ON PAVEMENT SURFACES. The brooms used to produce a roughened surface on the portland cement concrete pavement shall be street brooms with split bamboo bristles or metal-bristle brooms made especially for this purpose. The length of the broom handle shall be at least 1/2 the slab width and the broom width shall not be less than 14 inches.

(2) FOR USE ON SIDEWALK SURFACE. Brooms used for finishing sidewalk surfaces shall be of the hair or bristle type, and shall be not less than 14 inches in width. Nylon brooms shall not be permitted.

(E) HAIR BRUSHES. Brushes used for finishing concrete curb shall be of the hair or bristle type. Nylon brushes shall not be permitted.

(F) METAL TINES. For texturing concrete surfaces on bridge decks, metal tines shall be 0.03 inches thick, 0.08 inches wide and four to six inches in length. Average transverse groove spacing shall be approximately 1/2 inch. Broom shall be a minimum of 18 inches wide.